

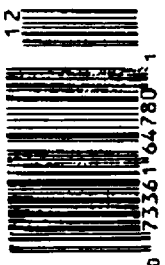
IS GARBAGE AN ENVIRONMENTAL PROBLEM?/INDIGENOUS GARDEN/SWAMP SCIENCE

GARBAGE

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While old lead paint is the
biggest contributor to lead
poisoning, new studies
suggest an equally ominous
source: lead in drinking
water. The good news is most
homes do not have abundant
lead molecules flowing
through the tap. If yours
does, there are a number of
steps you can take for...

All over the country people stopped, coffee halfway to lips, to read the morning's headlines: "Lead in Ourltown Water!" This past May, when the EPA released the first comprehensive tests of municipal water supplies, at first blush it seemed a lot of cities were feeding their citizens tap water laced with toxic lead. The study found that lead in drinking water exceeds federally permissible levels in almost one-fifth of the nation's largest cities.

While lead is not a metal to mess with — even at relatively low doses it causes irreversible damage to children's intelligence, among other things — not every citizen of every town on "The List" is drinking dangerous water. And by the same token, the water in towns that escaped The List is by no means lead-free. The List was just a roster of 816 public water systems where the EPA drinking water survey discovered too much lead coming out of the faucets in some "high-risk" houses with lead service lines or with interior lead pipes and soldering.

Because the water tests were directed at high-risk homes, they do not represent average lead concentrations in home water for those communities. However, according to the newsletter *Child Health Alert* the high levels were not worst-case situations, which occur when water is left standing in the pipes for one to three days.

The tests (indirectly) tell us that most people who have soft, acidic water should have their water tested for lead and that some people, including all infants, should have their blood tested, too. At high exposures lead is a serious health hazard, and mounting evidence has established that it's a significant hazard at ever lower exposures.

Lead in drinking water comes from plumbing of a certain age or type of city water line, or even certain properties of the water itself. (The softer and more acidic the water, the more corrosion in the pipes and the more lead in the water.) Most homes do not have high lead-levels in drinking water. But when it does crop up, leaded water is often a very private sort of problem, which is both bad and good. True, the lead in your water may be leaching from inside your own plumbing. But at least there are abundant solutions you can institute right now, without waiting for a govern-

Getting th



Let Lead Out

ment program to come clean it up.

THE SILENT SYMPTOMS

WHEN ASSESSING THE HEALTH RISKS OF LEAD, WE SHOULD FIRST consider this footnote: It's not a theory — the risks of lead exposure are not drawn from models or calculations.

According to the federal Dept. of Health and Human Services, "lead-risks are well known from studies of children and are not extrapolated from data on lab animals or high-dose occupational exposures." Don't trust the



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government? In a review of the epidemiology of childhood lead poisoning over the past 40 years, published in the Spring '93 issue of *The Milbank Quarterly*, author Barbara Berney reports that by the late 1980s toxicologists had established a clear dose-response relationship linking lead and neurobehavioral problems.

"Although the neurobehavioral effects of lead, as measured by standard development and IQ tests, may not always be the same, its biochemical effects were well documented and specific," writes Ms. Berney. "Extremely high exposures to lead cause encephalopathy and death, lower doses cause severe retardation, and lesser doses lead to school problems and small but significant shifts in IQ."

In recent years, many lead-targeted epidemiologic studies have focused on low-level exposures, according to Dr. Herbert Needleman, who's been studying the neurobehavioral effects of lead for the past 20 years and has a clinic at the University of Pittsburgh. Commenting in the *American Journal of Public Health*, Dr. Needleman reports that almost all of the stud-

ies "conclude that lead is associated with disturbances in cognition, behavior, and attention at levels below those that cause frank symptoms."

Lead is a heavy metal with no known physiological value in humans. How does lead affect human health? Reports drawn from the *Harvard Health Letter*, *Medical Update Quarterly*, and *American Family Physician* provide a summary.

Lead is an element that cannot be broken down into something else. Kidneys and organs cannot excrete lead, and it tends to remain once ingested or inhaled. Almost any body tissue can absorb it, although 90 percent of it ends up in our bones. Unfortunately, not much information exists yet about the potential

hazards of lead that comes from bone.

Lead acts primarily by disturbing enzyme systems, such as the one involved in the formation of hemoglobin (the molecule that transports oxygen through the bloodstream to organs and tissues). When extremely large amounts of lead are present in the blood — over 80 micrograms lead per deciliter of blood (g/dL) in adults and over 40 g/dL in children — practically every part of the body pays a price, especially the nervous system and kidneys.

Lead is particularly toxic to children for the following reasons: incomplete development of the blood-brain barrier before age three allows lead to more readily enter the central nervous system; ingested lead has 40 percent "bioavailability" (the portion of the ingested dose that's absorbed by the intestines) in children compared with 10 percent bioavailability in adults; frequent hand-to-mouth activity greatly increases the risk of childhood ingestion.

It's impossible to discuss the sources of lead without talking about old lead paint, which is the biggest contributor to lead poisoning. Children also pick up lead from contaminated

Testing the Waters

Water-testing labs are certified by the states, which follow standards dictated by the EPA.

The "first-draw" sample is most common, but not sufficient. It's taken from the cold tap after the water has been soaking in the pipes for at least 6 hours. It's usually the worst-case scenario. EPA recommends a one-liter sample. If the lab asks for a cup, take a one-liter sample, shake it, and pour off a cup.

A "flushed-line" sample is taken after running the water for a minute or two. This is supposed to demonstrate that you can get safe water from your tap. Flushed readings may be higher than the first draw, especially if your city's service lines are lead. Have both done. Because of discrepant readings like Hannah's (20ppb from one lab, 37 from another — see p. 30), consider testing twice — temperature, water acidity, and other important factors change daily.

If your reading is more than 15 ppb, you're in the action range. See "Purging Lead," in the main story, for steps to take.

As for finding a lab, many water districts are testing for free these days. If they say no, ask for a list of nearby certified labs. In the mail-away department, Consumers Union recommends the following labs. Prices are for two samples, a first-draw and a flushed-line: Suburban Water Testing Labs, Temple, Penn.: (800) 433-8386, \$36. National Testing Laboratories, Cleveland, Ohio: (800) 458-3338, \$36. Clean Water Fund, Asheville, N.C.: (704) 281-0818, \$17.

soil, and from the clothing of parents who work with lead. And about 20 percent of the lead kids may collect comes out of the faucet. Cases aren't commonly attributed to water alone, although formula-drinking infants in high-lead cities constitute a serious exception since the child drinks 32-40 ounces of water daily. Water is more often an accomplice than a sole villain. Whatever the sources of lead, the results are the same.

With a growing body of evidence showing that even small amounts of lead erode IQ and cause behavioral disturbances, the Centers for Disease Control lowered the definition for lead toxicity to 30 g/dL in 1978 and then to 25 g/dL in 1985. After another review of the latest data, in 1991 the CDC

IOULD FIRST CONSIDER THAT IT'S NOT DRAWN FROM STUDIES OF CHILDREN.

concluded that lead toxicity is found at levels of 10 g/dL — one-fourth the level of 20 years ago. (The CDC do not actually know if levels below 10 g/dL are without effect or even safe.)

"The new definition puts an extraordinary number of children at neurotoxic risk," writes Dr. Needleman in the *American Journal of Public Health*. "Data indicate that 17 percent of all children, regardless of race or socioeconomic status, have blood lead levels in the toxic range."

What is lead's neurotoxic effect? The CDC believes that any child with 10 g/dL at age two can expect a deficit of four to six IQ points when IQ stabilizes at age 10. Add to that the EPA's conservative rule of thumb: For every 10 parts per billion of lead in the water, a child's blood lead will rise by 1 or 2 g/dL over the course of a year. A two-year-old would have to drink water with 50 ppb lead to accrue a blood-lead level of 5 to 10 g/dL, and lose two to six IQ points. Water with 50 ppb lead is not common, but it exists, especially in lead-heavy cities like Boston and Chicago. (The EPA review of municipal water supplies found ten communities with lead-levels at more than 70 ppb.) Often, it's water's cumulative effect with other sources that should be a concern.

The prognosis for lead-poisoned children is widely variable, because of individual tolerances, age, diet, family, and medical care. But the majority of cases lie in the IQ-damage range of four to 15 points (IQ between 85 and 115 is normal). Currently, these deficits appear to be permanent, but doctors generally believe that a motivated child can compensate for some attention-deficit disorder and lost IQ.

The bottom line here is that, as the CDC says, "Virtually all children are at risk for lead poisoning."

Given the reduced upper limit for safe lead concentrations, combined with evidence of significant dispersion of lead in the environment, many experts conclude that lead poisoning is the health problem that affects the largest number of American children. Those whose homes are known to house lead should be screened first at six months; all children should be screened by one year of age. A blood-lead level of 10 g/dL or more should trigger parental detective work to discover if

Home Filter Options

Consumers Union is the undisputed authority on water filters, which it rates in the February 1993 *Consumer Reports*.

Lacking guidance from EPA on who should use a filter, CU took it on itself to set some standards. They generally advocate that anyone who is vulnerable (pregnant women, children under six, and anyone with high blood lead), and whose water shows any lead, should use a filter — the more lead, the better the filter. Even for people not at risk, they recommend a filter if the first-draw sample shows more than 15 ppb lead, or the flushed-line, 5 ppb.

There is no one perfect filter for removing lead. All of them have drawbacks, yet the majority do a good job in homes where lead contamination is not extreme. When shopping for a filter, consider the severity of lead contamination in your drinking water and the amount of water you consume, in addition to price and efficacy. The best filters, distillers and reverse-osmosis models, remove an impressive 99 percent of lead.

CU calls distillers a "good choice if you need highly effective lead removal." Distillers evaporate water, then condense it in a separate container, leaving impurities behind. They use electricity and generally take several hours to purify a gallon of water. CU likes the Sears Kenmore Distiller #3460, at \$100.

Reverse osmosis filters force water against a membrane that rejects large molecules. They are best for homes needing "maximum lead removal," says CU. They waste as much as 30 gallons of water a day and they're somewhat pricey: CU's two picks are Culligan Aquaclear System H-63 (\$750), and the Sears Kenmore 3400 (\$399).

Comparably less-effective models — and they still get between 81 and 98 percent of the lead out — depend on trade-secret filters. Among the configurations are:

Under-sink: Drill a hole in your sink, and add a little faucet fed by the filter. Less pricey than reverse osmosis units, under-sink filters are best for households which consume a lot of water. CU liked the Selecto Lead-Out 20, at \$85; the Multipure MP3000, at \$330, looks good, too.

Countertop: A tube connects your faucet to the cylindrical filter, which has its own faucet. They take up counter space but do not require major plumbing changes. CU found the Ametek CT C600-B, at \$85, to be cheap and fairly fast.

Faucet-mounted and carafe-style filters are generally effective and less expensive than other solutions, although CU found performance problems or extravagant maintenance costs with some models.

Outside of CU's recommendations, look for a lead-removal claim, along with a NSF seal, which means the unit has passed rigorous testing. For a list of certified units, write National Sanitation Foundation, drinking water treatment units, P.O. Box 130140, Ann Arbor, MI, 48113-0140.

the lead is coming from paint, soil, dust, ceramic glaze, water, or even school or day-care sources.

FACING THE FAUCET

HANNAH HAD HER WATER TESTED TWICE, AND GOT DIFFERENT instructions from each tester. The Portland Water District wanted one liter in their own plastic bottle; Maine Environmental Laboratories wanted one cup, in any plastic container. Maine Environmental said to put the sample on ice until she could deliver it, while rwd made no mention of temperature. The rwd test was free; the commercial lab charged \$24.

Hannah's is not a risky house, or so she thought. Though it's old, the original plumbing is long gone, replaced by copper. The city lines are not lead. But between the reservoir and the tap, there are numerous places where lead can seep in. (See diagram, at right.)

The water mains that run under city streets are generally cast iron. It's the service line — the pipe that runs between the main and your house plumbing — that presents the first big problem. In cities over 100 years old, it is likely to be lead.

Next are the home's own pipes. Lead plumbing was used through the 1920s. But most of these houses have been replumbed by now. (Lead pipe is a dull gray color and can be scratched with a file — if the exposed metal is shiny, you've got lead. New copper is about the same color as a new penny.)

Copper pipes don't mean you're home free. Lead solder wasn't banned until 1988, so any home plumbed before then probably has it. Even after that, many plumbers used it — it was legal for other uses, and it worked better than the early lead-free solders.

Not done yet — even a faucet that's marketed as "lead free" is permitted to contain up to 8 percent lead.



and they may be responsible for as many high readings as solder. Virtually all metal faucets have brass/lead valves, but in a matter of months, their leaching theoretically ceases. Any one of these sources can loft lead readings well into the danger zone.

So, while public officials target their concern on "high risk houses," with a lead service main or fresh solder (10 years old or less), it's abundantly clear that any house with any source of lead is at some risk.

Yikes! A few days after Hannah took her water samples, rwd reported that she had been drinking water with 37 parts per billion (ppb) lead. The action level is 15 ppb.

All of this testing business started in May of 1991, when the federal EPA ordered public water suppliers to monitor the tap water in hundreds of thousands of "high risk" homes. The

point was to detect systems where 10 percent of the houses showed more than 15 ppb lead. When Consumers Union conducted its own round of national testing, published in the February 1993 *Consumer Reports*, it seemed to show that EPA had indeed found the high-risk houses. Readers who sent in water samples being a more general sample, only 4 percent of their "worst-conditions" samples measured above 15 ppb. The nation as a whole, *Consumer Reports* reports, isn't suffering from widespread, high-level lead.

The single, solitary way to know if you're drinking dangerous levels of lead is to have your water tested. Twice. Shortly after rwd phoned with Hannah's 37 ppb diagnosis, Maine Environmental called to say the reading was 20 ppb. Hmmm. The discrepancy could be blamed on different temperatures (warmer water will leach more lead), or how hard the faucet was turned (rushing water will dislodge more lead), or even on something called politely "sampler error" (collecting the water in a dirty jam jar). Had she just received the 20 ppb result, she'd be less rigorous about her new regime — not a comforting realization. (See *Testing the Waters*, p. 28)

PURGING LEAD

THE FIRST STEP IN GETTING THE LEAD OUT IS FINDING WHERE IT'S getting in.

In Hannah's case, her service line is galvanized steel, according to rwd. She calls the National Sanitation Foundation [(313) 769-8010] to locate Delta, which made her sink faucet. Delta says the chrome faucet houses a brass valve which contains lead. It's also likely that a sloppy lead-solder job is donating its molecules to the morning coffee. So she calls the EPA's Safe Drinking Water Hotline — (800) 426-4791.

"You might ask a plumber to change your plumbing," she's told. She's also advised to get the *Consumer Reports* story from the library, and think about buying a filter system. Final-

AVING A PLUMBER CHANGE THE HOME'S PLUMBING IS (COST OF TEARING DOWN THE WALLS AND RESOLDER IN

ly, she's given the simple answer: Flush the line before drinking, and never, never, never cook with hot water. To repeat:

- For drinking purposes, fill a pitcher when you finish a chore that flushes the cold-water line — flush as long as it takes for the water to run cold, 30 seconds to two minutes. Keep it in the fridge. Keep out another pitcher for cooking, etc.
- Never, never, never cook with hot water. It leaches much more lead from the pipes.
- Don't boil water longer than necessary, as this will concentrate any lead in the water.
- Use bottled water to make baby formula.

The next practical steps are...

- Hannah is considering a plastic faucet. This eliminates brass/lead valves. Nibco makes \$40 to \$70 PVC-free plastic faucets (chrome plated) that are lifetime-warranted. (800) 642-5463.

- After that, she'll get her water tested again, and consider buying a filter. (See Home Filter Options, p. 29.)
- Having a plumber change her home's plumbing, however, is out of the question. If there was one section of lead pipe — perhaps. But the cost of tearing down the walls and resoldering every joint is off the map.

The final strategy is...

- Wait. EPA is requiring all public water systems to come up with a lead solution by 1997. One option is to "balance" the water. It is soft, acidic water that chews lead out of pipes. Adding basic agents (lime, baking soda), reduces the acidity. But often, this isn't enough.

Another response is to artificially harden the water, adding compounds like orthophosphate or silicates that will coat the pipes, entombing the lead. (Phosphates, long implicated in causing algal blooms in lakes, however, have proven their adaptability by causing them in Boston's water mains.) While none of these additives presents a health threat, they may require the construction of new facilities at the treatment plant. This would be especially expensive for small systems with few customers to share the burden.

A final option is to exhume and replace lead service lines with copper or PVC plastic. The City of Denver just did this at an expense of about \$432 per house.

Copper isn't a miracle cure, though. Copper corrosion presents a health problem in its own right. But it's much easier to beat than lead — the drinking water survey found copper to be under control. And PVC? "In a few years, we'll probably find out there's bad stuff coming out of plastic pipe," chuckles George Craft, resources engineer for the American Water Works Association. "That's pure conjecture — we're going to find that everything has bad stuff coming out of it. But who wants to live to be 500 years old anyway?"

Thanks, George.

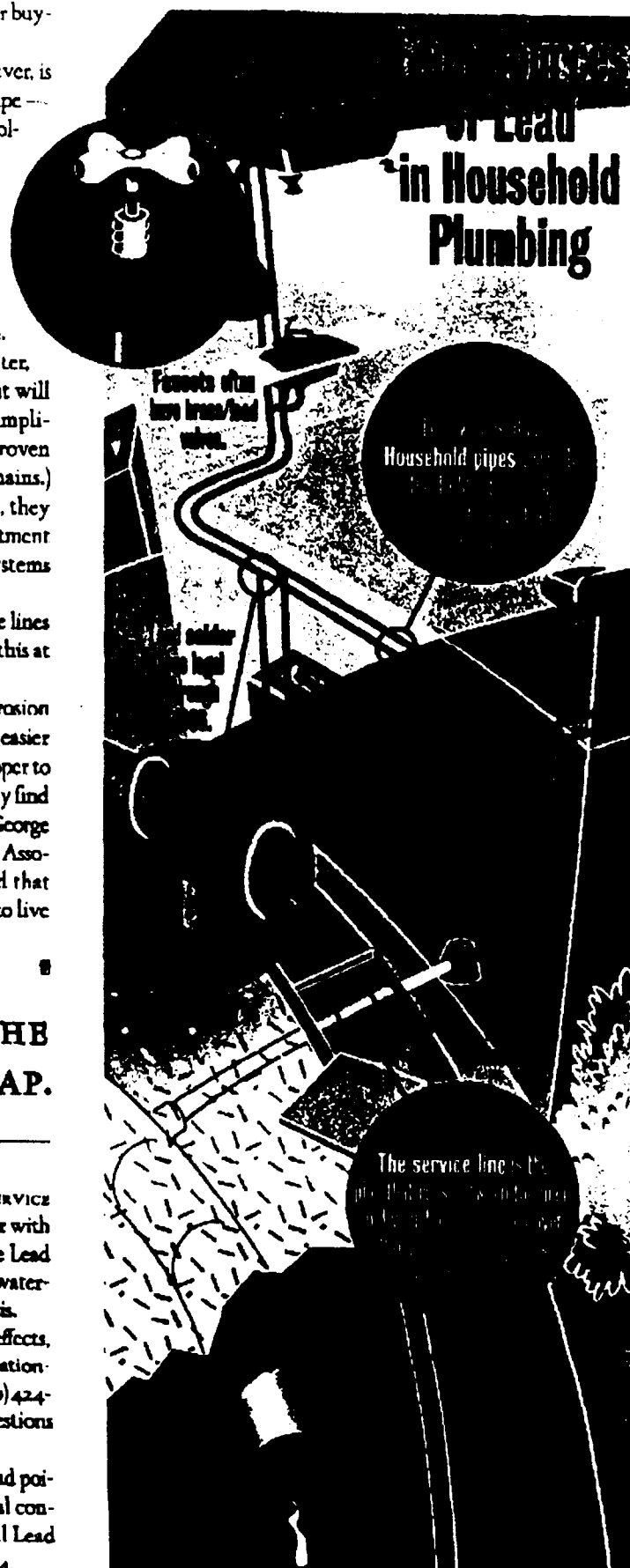
LEAD IS OUT OF THE QUESTION — THE BRING EVERY JOINT IS OFF THE MAP.

FOR MORE INFO

YOU CAN TEST YOUR HOUSE FOR LEAD PAINT BY USING A SERVICE that may be available from your local health department or with an kit that you can obtain for \$49.95 ppd. by calling the Lead Institute at (800) 532-3837. The Institute also supplies a water-testing kit for \$39.95 ppd. Both prices include lab analysis.

If you've got questions about lead sources, health effects, or other matters, you can call the federal government's National Lead Information Center clearinghouse toll-free at (800) 424-5323. Specialists are on hand to answer lead-related questions Monday through Friday, 8:30 am to 5:00 pm EST.

For a brochure on how to protect children from lead poisoning, fact sheets on testing, and a list of state and local contacts who can provide more details, dial the National Lead Information Center's toll-free hotline at (800) 532-3394.



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[Jonathan] Adler's criticism of your article "Getting the Lead Out," on the national scientific consensus on lead's toxicity, and of my work, relies not on scientific data, but on selective quotation of secondary sources. He quotes Marjorie (continued on next page)



Smith, whose single piece of research on lead and children's IQ was published 12 years ago. When her data was reanalyzed by her colleague Stewart Pocock, a clear effect of lead on IQ in males was reported.² This was ignored by Adler.

He states that average blood lead levels in the 1970s were well above 20 µg/dL. He is wrong. There is not one authoritative piece of evidence to that point. He notes the real decline in blood lead levels over the past decade (due in large measure to the removal of lead from gasoline) and asks the reader whether they believe that people in the past who had blood lead levels above 20 µg/dL were poisoned. Any scientist or fair reporter would trouble to look at the data. He would find a wealth of good studies in humans and in experimental animals that show effects of lead on central nervous system function at levels well below 20 µg/dL. These studies have caused the Centers for the Disease Control, the Agency for Toxic Substances and Disease Registry, the American Academy of Pediatrics, and the EPA all to agree that lead at levels of 10 µg/dL is neurotoxic.

This data base is too formidable for Adler to attack, so he selects one sentence from a Hearing Board Report. This Board was convened because two lead industry consultants accused me of scientific misconduct. The Hearing Board found no evidence to support these charges:

The Hearing Board find that there was no fabrication on the part of Dr. Needleman in the conduct of his research. What is particularly important is that we found no evidence of deliberate falsification of data, procedures or analysis that would bias the results in favor of finding a harmful effect for lead on the neuropsychological development of young children. The Board also

finds that the data file which Dr. Needleman has shared with us and others contains the primary data available for the 370 children for whom psychological data were collected and that it accurately reflects the data actually collected between 1975 and 1978. The Board is also confident that these data reveal a harmful effect of lead among the 370 children with a variety of analytical approaches. The Board found that most aspects of this study that were being disputed by the complainants and Dr. Needleman's critics were honest differences in how such studies should be conducted or in interpretation and judgments of data. Finally, perhaps the most remarkable feature of the protocol is that it exists in the first place. If Dr. Needleman had the intent of fabrication and falsification of results, much of the protocol would have been buried long ago. Indirectly, the Board sees this as inconsistent with the intent to be scientifically fraudulent.

Adler obviously had this report in hand, but ignores these statements and many others. Nor does he mention that since my first article on lead and children's IQ was published in 1979, there have been over 20 published studies modeled on mine which show similar findings. All are in well-known referenced journals available at any medical library. It requires a special kind of hubris, given his selective way with documented facts, to presume to counsel journalists on what constitutes a proportionate response to the problem of lead in society.

Herbert L. Needleman, M.D., is a Professor of Psychiatry and Pediatrics at the University of Pittsburgh Medical Center.

YOU WERE RIGHT THAT MOST HOMES DO not have high lead levels in drinking water. As *Consumer Reports* noted, "the nation as a whole is not suffering from wide-spread high-level lead."

Yet I question your reliance on the

theory that low blood lead levels have a clear dose-response relationship with IQ and neuro-behavioral problems. With respect to low blood lead levels, all relationships are based on extrapolated theories. Very recently (February 1993), a group of international experts on lead toxicology from the World Health Organization found that studies "cannot provide definitive evidence of a causal relationship with lead... The essential problem is that observational epidemiology cannot provide definitive evidence of causality when the key statistical association is small, the temporal relationship is unclear and major confounders are present."

To suggest that virtually all children are "at risk" for lead poisoning is like saying virtually all children are at risk for getting struck by lightning. It is important to put lead poisoning in perspective.

Children's blood lead levels now average 4-6 µg/dL, about 1/2 the lowest level of concern. More importantly, they have declined significantly over the past 20-30 years and are expected to continue to drop. Most of today's parents had levels above 20 µg/dL (considerably above the new "concern level" of 10 µg/dL) when they were children.

— JEFFREY T. MILLER
Director, Environmental
Health & Government Affairs
Lead Industries Assoc., Inc.
New York City

Correction: "Getting the Lead Out" (Nov/Dec. '93) notes that lead concentrations in blood are measured in micrograms per deciliter, or µg/dL. During production, the font interface between our computer and electronic type failed, diminishing the "µ" character and rendering the abbreviated expression as "g/dL," or grams per deciliter. As one reader pointed out, "a kid with 80 g/dL blood-lead would be dead."

² Pocock, S.J.; Adler, S.; Smith, M.A. (1977) Lead exposure and children's intellectual development. *Environmental & Epidemiology*, 16, 57-67. U.S. Environmental Protection Agency The Solid Waste Disposal Act Amendments of 1990, Office of Solid Waste EPA/530-SW-90-019 (Washington, DC) February 1990 at P. 41 and 42.3. U.S. Environmental Protection Agency The Solid Waste Disposal Act Amendments of 1990, Office of Solid Waste EPA/530-SW-90-019 (Washington, DC) February 1990 at P. 41 and 42. U.S. Environmental Protection Agency Characterization of Municipal Solid Waste in the United States 1972 Update, Office of Solid Waste and Emergency Response EPA/530-SW-90-019 (Washington, DC) July 1990 at 63-6.